A FOUR-COMPONENT PHEROMONE BLEND FOR OPTIMUM ATTRACTION OF REDBACKED CUTWORM MALES, Euxoa ochrogaster (GUENÉE)

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Abstract—Four acetates, Z-5-decenyl acetate, Z-5-, Z-7-, and Z-9-dodecenyl acetates, in microgram ratios of 1:200:2:1 or 1:200:6:2 were excellent, specific sex pheromone blends for capturing male redbacked cutworm moths in cone traps. Blends in ratios of 1:200:2:1 and 2:200:2:1 at 1000 μg/rubber septum dispenser remained highly effective for 6 weeks under field conditions. The essential minor components, Z-5-decenyl, Z-7-, and Z-9-dodecenyl acetates, became inhibitory at concentrations of about 10% in the blends, and this may be an important general phenomenon in lepidopteran pheromones. Blends involving a parapheromone, Z-5-undecenyl acetate, with Z-5-, Z-7-, and Z-9-dodecenyl acetate, in microgram ratios of 8:200:2:1 or 20:200:6:2 were also excellent specific attractants for this species. The Z-8-dodecenyl acetate had no obvious effect on the attraction of the redbacked cutworm males.

Key Words—Redbacked cutworm, Euxoa ochrogaster, Lepidoptera, Noctuidae, sex pheromone blend, sex attractant, parapheromone, Z-5-decenyl acetate, Z-5-undecenyl acetate, Z-5-dodecenyl acetate, Z-7-dodecenyl acetate, Z-9-dodecenyl acetate.

INTRODUCTION

The redbacked cutworm (RBC), Euxoa ochrogaster (Guenée) (Lepidoptera: Noctuidae), is a major pest of cereals and several other crops throughout Canada and the northern parts of the United States. Struble and Swailes (1978) reported a species-specific sex attractant for RBC males. This was developed by systematically screening the relative attractiveness of about 2000 binary and tertiary combinations of highly purified (ca. 98-99%) saturated and monoolefinic acetates and alcohols of the C₁₀ to C₁₆ series that are
common to lepidopteran attractants and pheromones (Tamaki, 1977). The reported attractant that gave the most consistent catches of males consisted of Z-5-undecenyl acetate (Z\textsubscript{5-11}:Ac), Z-5-dodecenyl acetate (Z\textsubscript{5-12}:Ac), and Z-8-dodecenyl acetate (Z\textsubscript{8-12}:Ac) (99% pure) in a ratio of 1:25:50 at 1 mg/dispenser. The addition of 14% Z\textsubscript{7-12}:Ac as a fourth component in this blend inhibited the attraction of males. The use of 0.1-1.3% Z\textsubscript{5-10}:Ac rather than Z\textsubscript{5-11}:Ac in these blends was an effective attractant, but the addition of 6% Z\textsubscript{5-10}:Ac also inhibited the attraction of males (Struble et al., 1980).

The following compounds were identified in the ovipositor washes of the RBC females (approximate ratios in parentheses): 10:Ac (11), 12:Ac (11), E\textsubscript{5-12}:Ac (4), Z\textsubscript{5-12}:Ac (100), Z\textsubscript{7-12}:Ac (4), and Z\textsubscript{9-12}:Ac (trace, ca. 0.6) (Struble et al., 1980). The ovipositor washes contained a trace (ca. < 0.5%) of a decenyl acetate, and electroantennographic detector (EAD) and single receptor recordings with synthetic chemicals indicated that this was probably Z\textsubscript{5-10}:Ac. The Z\textsubscript{5-11}:Ac and Z\textsubscript{8-12}:Ac were not detected in the female ovipositor washes, although strong EAD antennal responses were recorded for Z\textsubscript{5-11}:Ac.

Analyses by high-resolution capillary gas chromatography (GC), GC-mass spectrometry (GC-MS), and ozonolysis showed that the 99% pure Z\textsubscript{8-12}:Ac used in the field screening tests (Struble and Swailes, 1978) contained 0.4% Z\textsubscript{7-12}:Ac and 0.2% Z\textsubscript{9-12}:Ac (Struble et al., 1980). It was not established whether the Z\textsubscript{7-}, Z\textsubscript{8-}, or Z\textsubscript{9-12}:Acs were essential for the attraction of the RBC males.

This report describes extensive field tests to determine the relative attractiveness of many combinations of synthetic chemicals based upon those present in the methylene chloride washes of the RBC female abdomen tips and tests of the synergistic or inhibitory effects of the corresponding alcohols. The relative effectiveness of the attractive four-component blend at various quantities per dispenser was determined over a 6-week period. The function of Z\textsubscript{5-11}:Ac and Z\textsubscript{8-12}:Ac in the attraction of RBC males was further investigated, and Z\textsubscript{3-} and Z\textsubscript{7-10}:Ac were tested as possible synergists in place of Z\textsubscript{5-10}:Ac.

**METHODS AND MATERIALS**

The chemicals were synthesized here (Struble and Swailes, 1975), except Z\textsubscript{8-12}:Ac and Z\textsubscript{9-12}:Ac, which were purchased from ChemSampCo., Columbus, Ohio. They were purified by argentation liquid chromatography using Lewatit\textsuperscript{®} SP1080 resin impregnated with silver nitrate (Houx et al., 1974), and samples of all chemicals (ca. 100 mg) were further purified by preparative GC using columns 2 m \(\times\) 5.3 mm ID with 5% FFAP or 5% OV-17 on Gas Chrom Q 60/80 mesh. Chemical purities ranged from 99.0 to 99.8% as